mycetes are wholly asexual forms, their so-called fruit representing a complex gonidiophore.

Leaving the Thallophytes, many signs of advance will be found in the description of the Muscineæ. Attention may especially be called to the very clear account now given of the embryology both of the Liverworts and of the true Mosses. In a future edition a fuller account of the vegetative anatomy of the latter class may perhaps be looked for.

In the group of the Vascular Cryptogams the changes have been very numerous. Goebel's view of the essential distinction between the forms in which the sporangium arises from a single cell, and those in which a whole group of cells takes part in its formation, gives the clue to the arrangement here followed. Indeed, there is no part of the book in which the author's own researches have given rise to more important results. The whole subject of the development of the sporangia, both among vascular cryptogams and flowering plants, is one which Goebel has especially made his own.

As regards other points, we may mention that the important subject of apogamy in Ferns is treated at length in the text, while the converse phenomenon of apospory, more recently investigated by Prof. Bower, is dealt with in an editorial note. The embryology of the whole group is treated much more completely than before, and illustrated by new figures. The brilliant discoveries of Treub in the Lycopodiaceæ are shortly recorded in a note, but his most recent work did not appear in time to be noticed.

Going on to the Gymnosperms, we find that the researches of Treub have here led to important advances in our knowledge of the Cycadeæ. The Coniferæ are treated very fully, and here it is more especially to the labours of Strasburger that the most important progress is due. To him are to be attributed most of the recent discoveries on the development of the macrosporangium and of the prothallus and embryo. It need scarcely be pointed out that these results, in conjunction with the investigations of the author himself, have demonstrated in every detail the homologies between Gymnosperms and Pteridophyta long ago detected by the genius of Hofmeister.

Before leaving the Coniferæ, attention must be called to an error which has, curiously enough, survived through several editions of Sachs's "Text-book," and through both the German and the English versions of the present work. At the middle of p. 337 it is stated that in Juniperus the lowest of the three cells derived from the oospore divides into four cells, each of which gives rise to a rudimentary embryo, so that four rudimentary embryos proceed from one archegonium. At the bottom of the same page we find the following sentence: "But *Picea vulgaris* agrees with *Juniperus*, inasmuch as the lowest of the three primary cells of the suspensor does not divide, but forms only one rudiment." Of these two contradictory statements the former is, of course, the correct one; in the sentence last quoted, *Thuja* should be read for Juniperus.

As regards the Angiosperms, the most considerable changes introduced relate to the development of the stamen on the one hand, and of the ovule and embryo-sac on the other. In the former case it is especially the work of Warming, in the latter that of Strasburger, to which our present knowledge of the facts is due. The treatment of all these subjects by the author of this book is singularly clear. The student will see how the homologies, which were so evident in the case of the Gymnosperms, can also be traced here up to a certain point, while he will also see exactly where our knowledge is still deficient.

The improved account of the embryology of Angiosperms may also be noticed, especially the interesting summary of Strasburger's investigations on polyembryony.

As regards the translation, both Mr. Garnsey and Prof. Balfour may be warmly congratulated on their success. Here and there a slight want of clearness may perhaps be noticed, but this is very rare, and scarcely any errors have been detected. One on p. 17 may, however, be pointed out. It is there stated that in the Myxomycetes "a plasmodium moves away from illuminated spots; if a stronger light is thrown directly upon these spots, a number of plasmodia collect in them." This does not express the fact as stated in the original, which is that, if *the plasmodia* be directly exposed to strong light, they form larger conglomerations. Again, at the top of p. 97, the phrase "*ins Freie*" should scarcely have been translated "into the air," in speaking of a submerged aquatic plant.

The explanation of terms at the end of the book will be of the greatest possible value not only to students but to botanists. We may hope that it will materially contribute to introduce order into the chaos of our terminology. We are glad to see the good old term *spermatozoid* replacing the inaccurate *antherozoid*, and we could wish that ovum could constantly be used for oosphere. Where clear homologies with the animal kingdom can be traced, it seems a distinct loss to ignore them.

On the other hand, we cannot feel satisfied with the word "sporophyte" for the asexual generation in the higher plants. "Sporophyte" is the correlative of "spermaphyte," and has actually been used by Luerssen and others in the sense of a Cryptogam, as distinguished from the seed-bearing Phanerogam. We should have thought that the older terms "sporophore" and "oophore" would answer every purpose.

In conclusion, we can only say that the appearance of this book marks the most important addition to our morphological literature since 1875. D. H. S.

MINERAL PHYSIOLOGY AND PHYSIOGRAPHY

Mineral Physiology and Physiography. A Second Series of Chemical and Geological Essays, with a General Introduction. By Thomas Sterry Hunt, M.A., LL.D. Pp. 688. (Boston: Samuel E. Cassino, 1886.)

THIS work, as its sub-title implies, is a continuation of the series of essays first published by Dr. Sterry Hunt in 1874, of which a second and revised edition appeared in 1878. The essays which make up the present volume have with one exception, that on "The Genetic History of Crystalline Rocks," already appeared in various scientific journals.

The principal title of the work is explained and justified by its author in the two first essays. Dr. Sterry Hunt advocates a return to the older and wider meaning of the term "physiology" as it was employed two

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centuries ago; he maintains that all the natural sciences fall into two great divisions, the descriptive or physiographical, and the philosophical or physiological. It seems scarcely necessary to point out that the term physiology is now so universally restricted to the study of the actions of organised beings that any attempt to make it include physics and chemistry, with a large part of geology and astronomy, as the author proposes, can scarcely be expected to meet with much success. In scientific terminology a struggle for existence is continually going on, and it is hopeless to fight against the results of selection: to endeavour at the present day to revive the older and wider meaning of the term "physiology," and to use it as a synonym for "natural philosophy" side by side with the modern and more restricted sense, must almost infallibly lead to confusion. Still more hopeless would it be to try and abolish the use of the term in its present accepted sense.

In the third essay, on "The Chemical and Geological Relations of the Atmosphere," Dr. Sterry Hunt states and defends his well-known speculation concerning the replacement of the carbonic dioxide which is being continually removed from the atmosphere by the processes of kaolinisation and of coal-formation. Rejecting the too obvious suggestion advanced by Stanislas Meunier and others, that the equivalent of the carbonic dioxide abstracted from the atmosphere by the processes in question may be returned to it from subterranean sources, the author insists that such supplies can only come from outside the earth's atmosphere, and must be cosmical in their origin. The fourth essay, following up some of the ideas hinted at in the third, deals with "Celestial Chemistry from the Time of Newton," and is principally occupied with a discussion of the nature of interstellary matter.

The two essays dealing with "The Origin of Crystalline Rocks" and "The Genetic History of the Crystalline Rocks" are devoted to a destructive criticism of various theories which have been propounded to account for the origin of the crystalline schists and gneisses, and the attempt to supply a new one. As is well known, Dr. Sterry Hunt is one of those who maintain that all rocks of this class are necessarily of Archæan age; unlike some of his contemporaries who share the same views, however, he does not shrink from what he believes to be the logical conclusion from these premises, and maintains that the formation of such rocks must result from actions of a very different kind from any now going on upon the globe. According to Dr. Sterry Hunt's idea, which he calls the "crenitic hypothesis," "the crystalline stratiform rocks, as well as many erupted rocks, are supposed to be derived from a primary superficial layer, regarded as the last portion of the globe solidified in cooling from a state of igneous fluidity." After the wonderful speculative flights of these two essays, Dr. Sterry Hunt returns to the ground of sober scientific thought in several essays where ordinary chemists and geologists will not find themselves altogether out of their depth.

The solid contributions made to mineralogical science by the author of these essays may perhaps warrant an attempt on his part to deal with the difficult and involved question of mineralogical classification. This subject he has treated in his essay, "A Natural System of Mineralogy," an elaboration of which is promised in a treatise on mineralogy now in preparation. Dr. Sterry Hunt adopts, as might be anticipated, a purely chemical classification; but his results, which differ in many important particulars from those both of Rammelsberg and Tschermak, do not attract us by their simplicity, and seem perhaps needlessly obscured by the adoption of a very cumbrous terminology.

The essay on "The Geological History of Serpentines" is one in which all the author's peculiar originality and boldness are displayed in their highest perfection. That in the face of the results obtained by the study of rocks with the microscope, anyone could be found to maintain at the present day the *aqueous origin* of many, if not all, serpentines, may seem startling to those who have not read the author's previous writings on the subject. The dexterous gliding over difficult and dangerous places, and the elaborate "figure-cutting" on a few strips of apparently solid ice, constitute one of the most remarkable displays of courage and skill ever exhibited—even by the great mental athlete of Canada himself!

The "Taconic" rocks have formed in North America the battle-ground for two rival schools of geological thought, exactly comparable to that afforded by the Alps to European geologists, and the Scottish Highlands to those of Britain. In the ninth and eleventh essays of the present volume, Dr. Sterry Hunt maintains and stoutly defends his well-known views concerning the origin and succession of the Archæan rocks. For him the most highly foliated schists and gneisses exhibit a stratification clearly due to some kind of sedimentation; in the mineralogical constitution of these rocks he finds evidences of geological age more trustworthy even than those of the organic remains in the later aqueous deposits, and relying implicitly upon this kind of evidence, he has evolved a universal classification for the Archæan deposits which he can apply equally to the rocks of Southern Europe and of British North America. At some of these results persons of less robust faith in Dr. Sterry Hunt's methods can only give way to "admiration," as, for example, when igneous rocks which have been demonstrated to be intrusive in Secondary deposits, are boldly claimed, on account of their mineral characters, as members of some Archæan "system"!

Throughout the present volume, as in the former one, Dr. Sterry Hunt keeps prominently in view his claims to priority, and jealously defends the originality of many of the ideas he puts forward. We cannot but think ourselves that the claim to originality is one which he need take the smallest care to insist upon. If no name had appeared upon the title-page of this remarkable work, every chemist and geologist glancing at its pages would have felt assured that its author could be no other than Dr. Sterry Hunt.

OUR BOOK SHELF

Through the Fields with Linnæus. By Mrs. Florence Caddy. Two Vols. (London: Longmans, Green, and Co., 1887.)

THIS enthusiastic book is the fruit of the author's visit to the land of Linnæus, and her journeys in his track. Its purpose is to tell the story of the life and labours of Linnæus with the local colour so far as it may be restored from contemporary and other records, and from the author's own experiences of travel. We find Linnæus here presented to us

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